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Electrocatalysis of chemically synthesized noble metal nanoparticles on carbon electrodes

Ling Zhang, Jens Ulstrup, Jingdong Zhang*

Department of Chemistry, NanoChemistry group, Technical University of Denmark (DTU), Denmark

Tel: +45-45252352. E-mail: jz@kemi.dtu.dk

Noble metal nanoparticles (NPs), such as platinum (Pt) and palladium (Pd) NPs are promising catalysts for dioxygen reduction and oxidation of molecules such as formic acid and ethanol in fuel cells. Carbon nanomaterials are ideal supporting materials for electrochemical catalysts due to their good conductivity, chemical inertness and low cost [1]. Improvement of catalytic efficiency and stability of the NPs is, however, essential for their wider applications in electrochemical energy conversion/storage. The activities of noble metal catalysts depend not only on their size, composition, and shapes [2] but also on their interfacial interaction with the supporting electrodes. In this work we aim at chemical production of size and shape controlled, specifically 22 nm cubic Pd NPs, and further understanding of the Pd NPs as electrocatalysts at the nanometer scale using both scanning tunneling microscopy (STM) and atomic force microscopy (AFM) which have proved to be highly efficient techniques to map the *in situ* structures of self-assembled molecular monolayers at molecular or sub-molecular resolution [3]. Electrocatalysis of the Pd NPs immobilized on atomically flat, highly oriented pyrolytic graphite (HOPG) will be investigated by electrochemical SPM. This study offers promise for development of new high-efficiency catalyst types with low-cost for fuel cell technology.

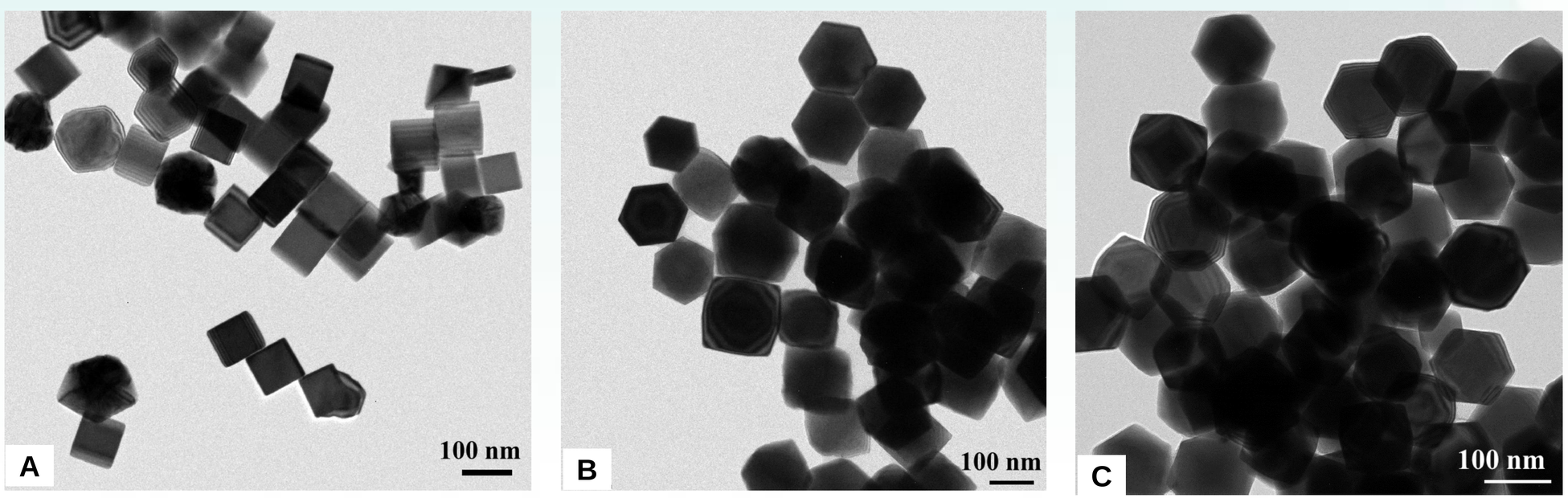

Figure 1. Transmission electronic microscopic images of Pd nanocrystals with different shapes synthesized by chemically seed-mediated growth methods. (A) cubes, (B) octahedra, and (C) rhombic dodecahedra.

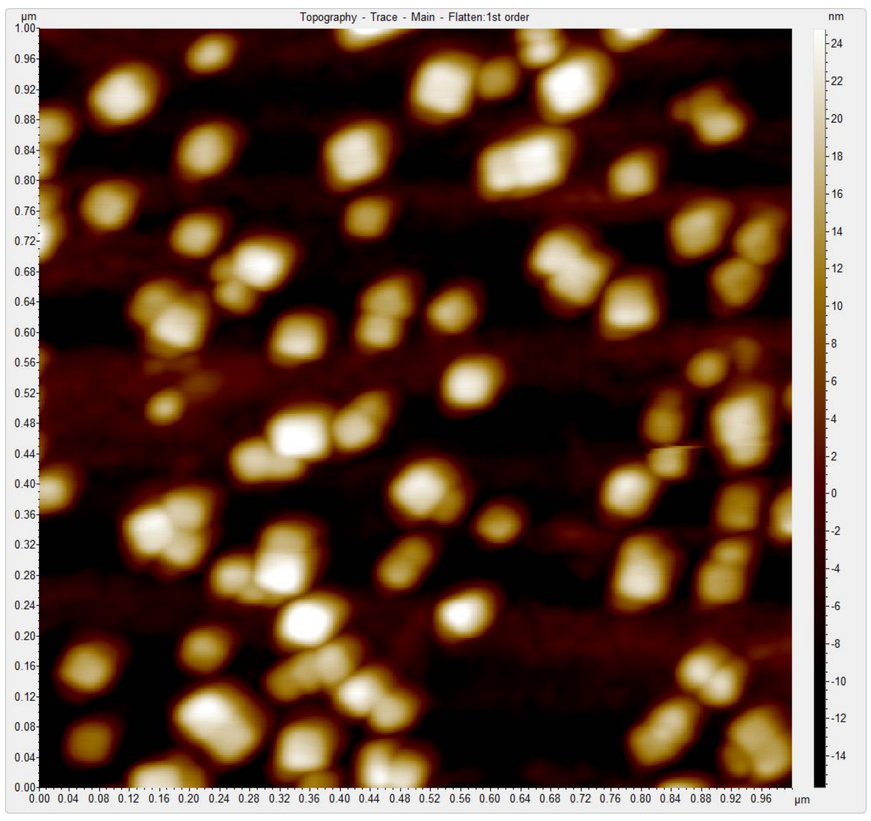

Figure 2. AFM image of 22 nm Pd nanocubes on highly oriented pyrolytic graphite (HOPG).

Acknowledgements

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